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RESEARCH ARTICLE

QUANTIFICATION OF PROPAFENONE HYDROCHLORIDE BY HPTLC METHOD IN ITS PHARMACEUTICAL DOSAGE FORM

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ABSTRACT

Background: Propafenone hydrochloride is an anti-arrhythmia drug which is available in tablet formulation. The aim of the present work is to develop and validate the HPTLC method for the estimation of propafenone hydrochloride in the tablet.

Materials and Methods: The optimized chromatographic condition with a mobile phase of chloroform: methanol: acetic acid (8:1.5:0.5 v/v/v), silica gel G60 F254 is used as the stationary phase.The UV detection of the spot was performed at 251 nm. Propafenone hydrochloride has an Rf value of 0.72.

Results: Propafenone hydrochloride calibration curve was found to be linear between 200 and 1000 ng/spot.The % recovery study was found to be 99.83%.

Conclusion: The suggested approach can be used to determine the amount of propafenone hydrochloride in a commercial formulation.

Keywords: Propafenone hydrochloride, Anti arrythmias, HPTLC, ICH guidelines.

INTRODUCTION

Propafenone HCl, also known as 1- [2-2 [Hydroxy-3-propylamino] propoxy] phenylpropane-1-one hydrochloride is employed as an anti-arrhythmic medication. In order to reduce the excitability of cardiac muscle cells, propafenone slows the entry of sodium ions into the cells. Propafenone blocks normal cells more than class 1a or 1b while being more selective for cells with a high rate.

According to the literature UV [4-6] Fluorimetric[7] Colorimetric[8], HPLC [9-16], LC-MS/MS [17-18]Capillary electrophoresis [19], Conductometric titration [20]methods has been reported for the estimation of propafenone. No methods have been reported in HPTLC for the estimation of propafenone. Therefore, the goal of the current work was to create a highly sensitive, cost-effective, precise, and selective HPTLC approach for the detection of Propafenone in its dosage form.

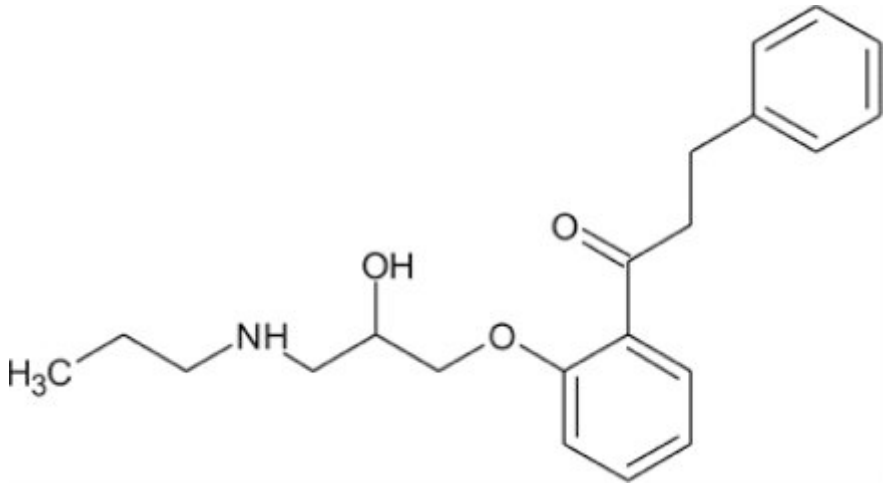

Figure 1: Structure of propafenone

MATERIALS AND METHODS

Chemicals and Reagents

The propafenone hydrochloride as a pure drug obtained from MMC healthcare, Chennai and the mobile phase was prepared using chloroform, methanol, and acetic acid as an AR grade obtained from Merck.

Instruments

Camag (Muttenz, Switzerland) Linomat 5 applicator, a Camag Twin trough TLC Chamber. Camag TLC scanner 3, CamagWincats Software, Hamilton (Reno, Nevada, USA) syringe (100 µl).

Chromatographic Conditions

Precoated aluminium plates with silica gel G60 F254 as the stationary phase are used

in the chromatographic settings. Chloroform, methanol and acetic acid comprise the mobile phase. The chamber saturation time is 30 min and the plate saturation within 10-12 min. The developing distance of the plate is 80 mm. The 5 mm bandwidth was used for the development approach. After development, the plates were dried in the air before being scanned at 251 nm using a Camag TLC scanner-3.

Standard solution preparation

Propafenone standard stock solution was made by dissolving 10 mg in a 10 mL volumetric flask with methanol.

Preparation of working standard solution

On a pre-coated TLC plate, a working standard solution of propafenone from stock solution was applied to get concentrations ranging from 200 to 1000 ng/spot. After being saturated with the mobile phase for 30 minutes, the plate was developed in a developing chamber. The plate was air dried after development and standard zones were measured by scanning at 251 nm. Peak areas versus concentration for each response was plotted to create the calibration curves.

Sample solution Preparation

The weight of twenty tablets containing 150 mg of propafenone was calculated as the average. 100 ml of methanol were used to extract a powder that contained 100 mg of propafenone. After filtering, methanol was used to dilute 1 ml of the filtrate solution to 10 mL. To determine the amount of propafenone in the tablets, peak area was assessed.

Chamber saturation time

At various intervals between 5 and 25 minutes, the chamber saturation time was measured and the effect of chamber saturation time on the development pattern, peak shape and R_f value was studied. It was found that a saturation period of 30 minutes resulted in acceptable component resolution with good peak shapes. As a result, a saturation time of 10 to 15 minutes was chosen.

Plate equilibrium (pre-conditioning) time

The pre-conditioning time for the plate equilibrium was determined with different time intervals from 5-30 min. In a twin trough chamber and peak area, R_f value and peak shapes were calculated. The precision and reproducibility of peak area were good, after 10 min, time of plate saturation was suitable for the separation.

Composition of solvents in mobile phase

The solvent composition in mobile phase was estimated using the drug resolution, peak shape and Rf value. It was found that increase in composition of chloroform or decrease in methanol concentration makes propafenone hydrochloride to move to the solvent front (no retention). The concentration of acetic acid determines the peak shape of the drug and in its absence, the peaks were highly asymmetric. As a result, numerous mobile phase proportions

were tested in order to get the best analyte separation. The symmetrical peaks with excellent separation were generated by the mobile phase of chloroform, methanol, and acetic acid (8:1.5:0.5 v/v/v).

Distance of solvent front

The Rf value of drug substances are influenced by the solvent's travel distance. The mobile phase was allowed to flow on the plates at various distances ranging from 6.5 to 9.0 to maximize the solvent front. The solvent front distance was set at 8.5 cm.

Band width

The drug was detected in various widths of bandwidth (1 to 5 mm) to estimate the band width for higher Rf and peak area. Following the development of the chromatogram, it was studied that a bandwidth of 5 mm produced the optimum Rf accuracy and peak area.

RESULTS

Linearity

A standard calibration curve for propafenone was produced with concentration versus peak area to explore linearity. The standard densitogram of propafenone are shown in Figure 2. The linearity of propafenone was good throughout concentration ranges of 200, 400, 600, 800, and 1000 ng/spot, as shown in Table 1. Figure 3 shows the slope and intercept values, as well as the correlation coefficient, which was determined to be 0.998.

Table 1: Data for Linearity

Concentration (ng/spot)	Peak area
200	1676.6
400	2546.1
600	3491.8
800	4354.8
1000	5462.8

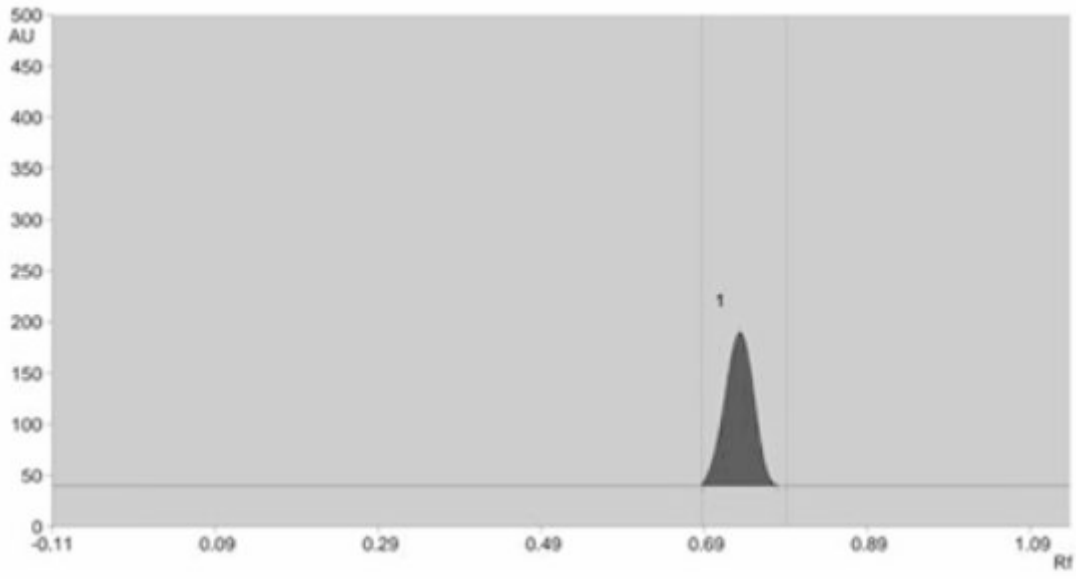

Figure 2: Densitogram of Propafenone API.

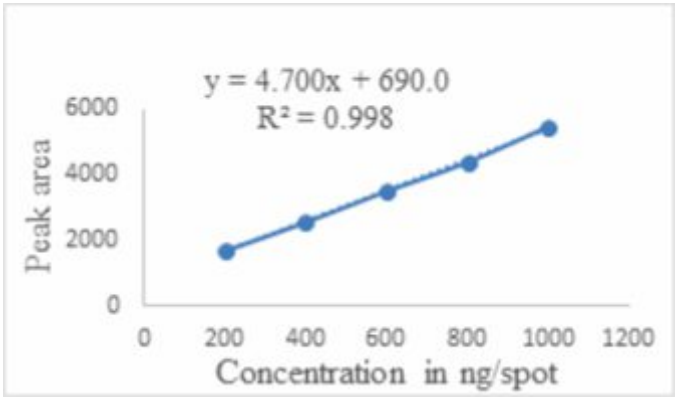

Figure 3: Calibration curve of Propafenone.

Precision

The method's precision was proved by intermediate (inter-day) and repeatable (intra-day) precision, which is quantified as the findings' RSD. The intra-day and inter-day precision experiments involved three concentration levels, with three determinations conducted for each concentration. Instrumental precision was studied, by repeatable application of same sample on TLC and the plate was measured six times without changing the position. Precision study results demonstrate strong repeatability and negligible intraday variability. Table 2 shows the accuracy of HPTLC data.

Table 2: Precision Data for Propafenone Hydrochloride.

Parameters	Intra day	Inter day
Mean peak	3170	3381
%RSD	0.845	1.831

Accuracy

The accuracy of the developed method was carried out using the standard addition technique. Standard drug was added to the pre-analysed formulation at 80%, 100%, and 120% concentrations. Table 3 shows the % recovery study findings, which varied from 99.83% to 100%.

Table 3: Accuracy of HPTLC Methods for Propafenone.

Level (%)	Amount added (mg)	Amount recovered (mg)	% Recovery
80	8	7.97	99.62
100	10	9.98	99.8
120	12	12.01	100.08
% RSD			0.95

Limit of detection and limit of quantification

The signal to noise ratio used to calculate the LOD and LOQ of drug in HPTLC was 3:1 and 10:1, respectively. Propafenone's LOD and LOQ values were calculated to be 11 ng and 57 ng, respectively.

Robustness

Modifying the experimental setting allowed for robustness evaluations was performed at ± 2 min, equilibrium time (chamber saturation), ± 2 min. plate equilibrium time (plate saturation), ± 0.2 ml in mobile phase proportion, ± 0.2 cm solvent front and stability of solution. The Rf values, aera and symmetry of peaks did not alter much. The % RSD was determined and the results are within acceptable ranges.

System suitability parameters

For the investigation of formulations containing propafenone, the HPTLC method's suitability parameters were calculated. Table 4 displays the efficiency and asymmetry factor that were determined.

Table 4: System Suitability of HPTLC Method for Propafenone.

Drug	Efficiency (N)	%RSD	Asymmetric factor (A_O)	%RSD
Propafenone	1856	0.856	0.72	0.522

Application of the method

Propafenone (150 mg) tablet assays were conducted using the suggested techniques. Accurately weighed tablets were used for six triplicate determinations. In Table 5, experimental results for finding propafenone in samples are shown. Figure 4 displays the formulation's densitograms.

Table 5: Result of Analysis of Propafenone in Formulation By HPTLC.

Propafenone Hydrochloride	Labelled amount(mg/tablet)	Estimated amount (mg/tablet)	% Label claim*	% RSD
Brand name - Pradil	150	149.91	99.94%	0.76

*Mean of six observations

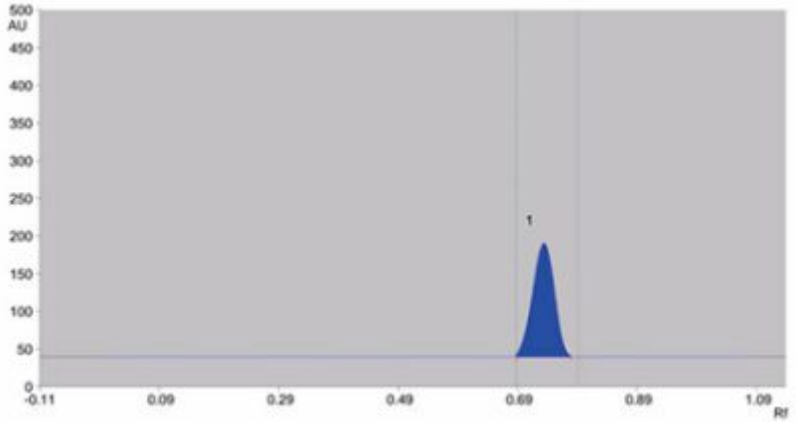

Figure 4: Densitogram of Propafenone in formulation.

DISCUSSION

The presence of propafenone HCl was determined using the HPTLC technique and the chromatographic parameters were optimized. The stationary phase was used as pre-coated silica gel G60F254. Parameters were improved by altering the mobile phase ratio and flow rate at a wavelength of 251 nm. A variety of mobile phases, including Toluene: Methanol (8.5:1.5, v/v), Chloroform: Methanol (9:1, v/v) and Methanol: Ethyl Acetate:

Ammonia (1.8:5:0.5, v/v/v) were tried and Chloroform: Methanol: Acetic Acid (8:1.5:0.5, v/v/v) was finalized for the study. The external calibration method was used to carry out the calibration. Plotting the peak area vs. concentration calibration curve. The correlation coefficient is less than 2 and the system accuracy was found to be 0.999 on both an intraday and an interday basis. The recovery studies were performed to validate the procedure's accuracy by adding the standard drug to a previously tested formulation. The observed average recovery rate was 99.8%. Calculated LOD and LOQ were within acceptable range. Robustness was achieved by deliberate changes to ideal circumstances such as chamber saturation, mobile phase composition and plate saturation.

CONCLUSION

An enhanced HPTLC technique with UV detection for determining propafenone in tablet dose form has also been developed and validated. Rf was determined to be 0.72. The linearity ranges are 200-1000 ng/spot for propafenone. The linearity data revealed that the developed method is linear. The precision and accuracy data lies within the reference range and the percentage label claim of propafenone hydrochloride was found to be 99.94 %.

Propafenone hydrochloride in tablet dosage form may be routinely analyzed using the HPTLC technique. The newly developed densitometric method is having high efficiency and quantification with less concentration levels when compared to reported methods.

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ABBREVIATIONS

HPTLC: High Performance Thin Layer Chromatography: UV: Ultraviolet: ICH: International Council on Harmonization: HPLC: High Performance Liquid Chromatography: LC-MS/MS: Liquid Chromatography Mass Spectrometry: AR: Analytical Reagent: TLC: Thin Layer Chromatography: RSD: Relative Standard Deviation: LOD: Limit of Detection: LOQ: Limit of Quantification.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest

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